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BIOLOGY AND THE NATION'S FOOD

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WE may, without argument, assume that at least a part of the recent rise in prices is due to the wastefulness of war. We know also that the crop year now closing was below normal, not only in this country, but also in others. If the entire difficulty were due to these two causes we might look forward to the future with complacency, for wars come to an end and bad seasons are only occasional. Let us inquire whether there are other, and more permanent, causes.

During the last decade of the last century the average price of farm land in the United States rose 108 per cent. During the same time there was an average increase of 67 per cent. in the price of farm products. Thus far in the present decade both these rates have been exceeded.

This increase in the price of land is due to two principal causes. In the first place, by the early nineties the more desirable portions of the public domain had been settled, and those who a few years earlier would have homesteaded new land were now confronted with the necessity of buying. This greatly increased competition, and prices rose accordingly.

But the very fact that good farm lands were not coming into cultivation as rapidly as formerly lowered the rate of increase in production. This caused higher prices for farm products, and this in turn a further increase in the price of land. It appears therefore that we have arrived at a period, or are rapidly approaching it, when increase in production of food no longer keeps pace with increase in population. Let us now consider a few of our leading food resources to see whether this conclusion is justified.

The average annual production of wheat in this country by ten-year periods for the last three decades has been, in bushels per capita, 7.3, 7.8 and 8.0, respectively. These figures indicate a slight increase in production as compared with increase in population. But these are ten-year averages. The area of our wheat crop for each of the last ten years, ending with 1915, has been, in millions of acres, 47, 45, 48, 47, 46, 50, 46, 50, 54 and 60, respectively. The marked increase last year may be attributed to the stimulating effect of the high prices incident to war. It must also be remembered that by far the greater portion of the land brought into cultivation during recent years lies in the western wheat-producing area. We can not expect the present increase in the area of new wheat lands to continue much longer. While the production of wheat last year shows that, under the stimulus of high prices, American farmers can still produce a big surplus of this commodity, there is also every reason to believe that such stimulus is necessary. At present we have reached a stage where any great increase in wheat acreage—in fact, an increase proportional to increase in population—can occur only by decreasing the area of other crops. This means that unless we are to have bread still higher in price we must devise means of increasing the yield of wheat per acre.

While wheat is our most important bread crop, corn is a far more important crop when considered in its entire relation to our national economy. It occupies nearly twice the acreage of any other crop, has a total value more than twice as great, and is the principal basis of meat production in this country. The per capita production of corn for the last four census years is 35, 34, 35 and 28 bushels, respectively. The total production for each of the last ten years has been, in hundreds of millions of bushels, 29, 26, 27, 28, 29, 31, 24, 27 and 31. These figures indicate practically no increase for the last decade, during which population increased probably about 20 per cent. Even the great crop of last year was only equal to that of three years earlier. It is evident that we have reached a point where increase in the production of corn is not nearly keeping pace with increase in population. In fact, the statistics indicate that it requires the stimulus of very high prices to bring about even a small increase in the volume of this our most important crop. One reason for this situation is that the West, where most of the lands now being brought into cultivation are found, is not adapted to the production of corn. The acreage of corn is so large that any considerable increase in it can occur only at the expense of other important crops, except as additional land is brought into cultivation in the corn-producing states, and this must, in the nature of the case, be a slow process. We must therefore look very largely to increase in the acre yield for future increases in this highly important crop.

Coming now to that class of food products represented by the fruits and vegetables, we shall find the situation quite different. The entire fruit crop of this country occupies only two and three fourths per cent. of our crop area; the entire crop of garden vegetables occupies another two per cent., of which two thirds is in potatoes. So far as available land is concerned, the area of crops of this character can be increased as occasion requires for a long period in the future. All available statistics indicate that the area of such crops is expanding as rapidly as there is any need for them. The problem of distribution of products of this character is becoming more or less acute, but when there is any actual shortage of any of them the resulting high prices almost invariably result in overproduction the next year, or as soon thereafter as a new crop can be matured. It would, however, be far from the truth to state that there are no problems connected with the production of fruits and vegetables. Some of these will be mentioned later.

In this connection it may not be out of place to remark that the present abnormal price of potatoes is due neither to the European war nor to an approaching permanent shortage in this crop. The crop planted last spring was in fact unusually large, and in some localities production was a maximum. But in several large producing centers there was an almost complete failure of the crop because of unfavorable weather. That potato production is keeping pace with increase in population is strongly indicated by the per capita production for the last four census years, which was 3.5, 3.5, 3.7 and 4.7 bushels. The figures for recent years confirm this conclusion. The only present menace to this crop is the possible introduction and spread of fungus diseases, which it is the province of the biologist to prevent. In this connection it may be noted that only recently quarantines were in force against the importation of seed potatoes from infected regions.

There was a time when the American people were probably the equal of any people in the world as consumers of meat. That was when we had an excess of good agricultural land. For the Caucasian race at least the per capita consumption of meat is closely related to the surplus of available farm land. At present we stand third in this respect, being exceeded by Australia and New Zealand, and closely followed by Argentina and Canada. The per capita figures for these five countries are 262, 211, 171, 140 and 137 pounds, respectively. At the present time Australians eat fifty per cent. more meat than we do. As already intimated, the per capita consumption of meat in this country is decreasing. For the year 1900 it was 182, and for 1909 it was 171 pounds, a decrease of 11 pounds in nine years. That this decrease will continue seems highly probable, though not necessarily at this rate.

The important food-producing animals of this country are, in the order of their importance, cattle, swine, poultry and sheep.

From the standpoint of our problem cattle must be considered in two classes, namely, dairy and beef, though there is considerable duplication in these classes. Dairying is, or can be made, a relatively intensive type of farming. For this reason its status can be maintained even when population becomes quite dense. At present the number of dairy cows in this country is increasing approximately in the same ratio as population, and there is reason to believe that this increase may continue for several decades at least. A future supply of butter and cheese seems assured, but there is some difficulty in the matter of supplies of market milk for our growing cities. This is largely due to the greatly increased cost of the methods which now appear to be necessary in the distribution of this product. Whereas milk was formerly retailed from cans, it must now be bottled. The big problem here seems to be that of reducing the cost of distribution. Improving the quality of the cows as a means of reducing the cost of production is also urgent.

The supply of beef cattle in this country has fallen off very materially in recent years. While at present high prices for animals of this class render it possible for the corn-belt farmer to grow much of the feeder stock formerly obtained from the ranges, there is no reason to believe that we shall ever see beef as plentiful and cheap as it was a few years ago, though the eradication of the cattle tick in the south, now in rapid progress, will open up a large area to beef production.

During the last census period there was an increase of about twelve per cent. in the number of swine in this country, as compared with a twenty per cent. increase in population. There was a decrease of about eight per cent. in per capita production of pork products. While beef cattle represent a relatively extensive form of agriculture, and may therefore be expected to decrease at least relatively as the necessity for more intensive agriculture becomes more urgent, this is not necessarily the case with swine. They can be produced within limits in a very intensive agriculture, especially in connection with the production of butter and cheese. The decrease in per capita production in recent years is due partly to the high price of corn and partly to the prevalence of diseases. Many farmers keep few or no hogs because of the danger of loss from this cause. The eradication of diseases of these animals therefore appears to be a problem of increasing importance.

Poultry farming is even more intensive than dairying. It is more or less prominent in China, where population is so dense as to exclude almost every other type of meat-producing animal. There is, therefore, no economic reason why poultry and eggs should not continue indefinitely to furnish the basis for breakfast and for the Sunday dinner as they have done from time immemorial. In fact, the decreasing supplies of other meats, especially beef and mutton, greatly emphasize the importance of the feathered tribe. The percentage increase in the number of poultry in this country during recent years has been only slightly less than that of population, but there has perhaps been a compensating increase in productiveness. This increase in productiveness is to play an important part in supplying food in the future, and is a biological problem of the first order.

Sheep husbandry as ordinarily conducted represents the least intensive form of live-stock farming. These animals can subsist where no other domesticated animal can live. Hence they occupy the dry regions of the earth, especially of Asia, Australia, Argentina and the western United States. But these regions can no longer supply any considerable proportion of the needs of mankind for the products of these animals.

Partly for this reason and partly because of the increasing scarcity of beef, the price of mutton has risen very materially in recent years, so much so in fact as to raise the question whether sheep may not again become an enterprise on the ordinary farm. These animals are subject to certain serious internal parasites that are of little importance when the animals are kept on the open range and seldom tread over the same ground twice in a season; but when confined on farms, where they must cover the same ground repeatedly each season, the problem of controlling these parasites becomes a difficult one. Here again we have a purely biological problem that is critical in connection with the rehabilitation of a farm enterprise that is assuming greater importance yearly.

To recapitulate. Our principal bread crops already occupy so large an area that there can be no large increase in them except as new lands come into use, a process necessarily slow, and as we increase the acre yield. The increase last year in the acreage of wheat and corn, brought about by abnormal prices, was mainly on land ordinarily devoted to pasture and hay. This is significant in connection with the decreasing supply of beef.

The production of fruits and vegetables can increase practically indefinitely, but even then the saving of acreage by increased yield is an advantage not to be ignored.

There is no economic reason why dairy and poultry farming should not continue to increase in magnitude as the need for their products increases. It is easily seen, however, that on account of the magnitude of these enterprises any considerable increase in production per cow and per hen, which we know need not entail a proportionate increase in feed consumed, may result in an enormous saving, most of which may readily be utilized in the production of beef, mutton and pork. The actual or relative decrease in the number of beef cattle, swine and sheep in recent years thus makes the increased productivity of the dairy cow and the hen a doubly important matter. Here is work of great importance for the biologist, and it is a matter of no small gratification that this work is being pushed forward in a most commendable manner.

In the presentation of this subject it has seemed more important to get a clear statement of what the situation is with reference to our future supplies of food than to confine myself to a list of the biological problems connected with increasing these supplies to meet the needs of an ever-increasing population. I have tried to present the situation in such a way as to make clear the relation of the more important of these problems to our necessities. In the time available here it would be impossible even to mention the notable achievements of the last quarter century and the important problems still awaiting solution. I will therefore confine my few remaining remarks to very general considerations.

It is clear that increasing the acre yield of crops is one of our very big problems. It assumes four phases, as follows: (1) Increasing the fertility of the soil, (2) improving cultural practise, (3) protection against diseases and pests, (4) improving the yielding power of the plant.

Most of the questions here involved lie wholly within the field of biology. Some of them involve so many sciences that their solution lags for want of closer cooperation between scientists whose interests are diverse.

Some of the more important phases of the problem of increasing the production of live stock products are: (1) A better understanding of animal nutrition; (2) the eradication or prevention of disease; (3) the suppression of insect pests, animal parasites, and the depredations of dogs and wild animals; (4) the improving of quality and productiveness by breeding and selection.

Great progress has been made in all these directions, but much remains yet to be done. It is a far cry from the 3,100 pounds of milk of the average American cow to the 30,000 pounds of Tillie Alcartra; from the five dozen eggs of the average American hen to the 26 dozen of Lady Eglantine. We can not hope to raise the average to these high figures, but the general application of principles already known and the successful completion of studies now in progress would go far in this direction.